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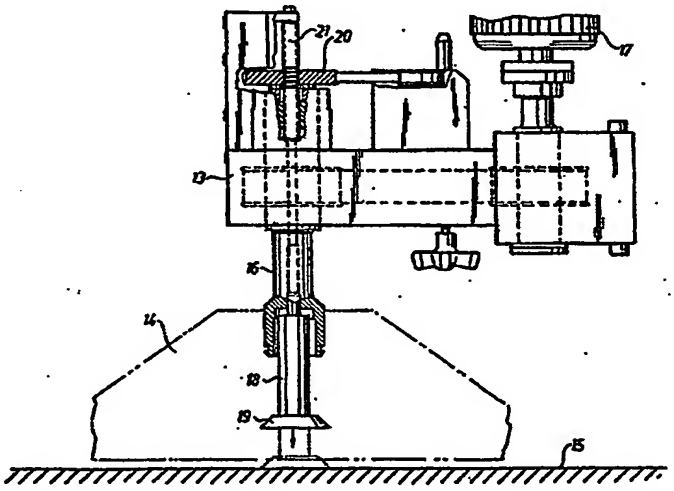

(57) Abstract

The invention concerns a device to drive and control a working vehicle arranged for treatment of a surface (15) thereof. The vehicle comprises for this purpose a driving wheel assembly (1) and two tools (14, 23) arranged, by their rotary motion, to perform said treatment of said surface (15). The driving wheel assembly (1) is rotatable about its centre (22) and is orientated with respect to the tools (14, 23) in such a manner that the imaginary interconnecting lines (24, 25, 26) between the centres of rotation (27, 28) of the tools (14, 23) and between the centre of rotation (22) of the driving wheel assembly (1) and the centres of rotation (27, 28) of the respective tools (14, 23), form a triangle, preferably an equilateral triangle. The device comprises means (18, 19) which are provided to relieve the load of the working vehicle on the tool against the surface (15) at the centre of any one of the tools (14, 23) for allowing said vehicle to pivot about said centre (27, 28) upon turning movement of said driving assembly for the purpose of changing the direction of movement of said working vehicle.

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A DEVICE TO DRIVE AND CONTROL A SURFACE-TREATING VEHICLE

The subject invention concerns a device for driving and controlling a working vehicle arranged to move forwards and backwards across a surface for treatment thereof. For this purpose the vehicle is provided with a driving wheel assembly and with two tools arranged, by their rotary motion, to perform said treatment of the surface.

Working vehicles and mobile machinery operating by means of several rotating tools on a surface are previously known, see e.g. US, A, 3,936,2112 and US, A, 4,046,484. The automation of the work that is made possible by such types of vehicles or machinery is advantageous, particularly if the vehicle may be remote-controlled.

However, it is also very important that the vehicle may be displaced across the surface in the most efficient manner possible, particularly when the vehicle is to turn, after having completed one operative path and having returned along an adjoining path. Known working vehicles all suffer from the disadvantage that upon turning movement of the vehicle a patch of the surface to be treated is left untouched. Reversal and/or displacement of the vehicle laterally to complete the treatment always is a disadvantage because of the delay in the treatment that arises in consequence thereof. When the treatment in question relates to trowelling or grinding of a newly-cast concrete floor it may even be quite harmful that the tools, owing to the additional manoeuvres that the reversal and lateral displacement of the working vehicle entail, will have to perform the work on the surface with uneven distribution as regards time per surface unit.

The purpose of the invention is to eliminate this drawback. The characterizing features of the invention appear from the appended claims. Owing to the device in

accordance with the invention the working vehicle may be driven on a support in a very smooth and adaptable manner, in a direction straight forwards as well as upon sharp turns while at the same time the device makes it possible to ensure, by simple means, that the working vehicle treats every part of the support in an equivalent manner.

The invention will be described in closer detail in the following with reference to the appended drawing figures, wherein

Fig. 1 illustrates a driving wheel assembly in a working vehicle in accordance with the invention in a lateral view,

Fig. 2 illustrates the same driving wheel assembly in a front view, partly in section,

Fig. 3 illustrates a tool arm in a lateral view, partly in section,

Fig. 4 is a schematical representation of the vehicle movements across a working surface,

Fig. 5 illustrates schematically the orientation of the relative positions of the driving wheel assembly of the vehicle and its tools, and

Fig. 6 illustrates one embodiment of a working vehicle in a perspective view.

The driving wheel assembly 1 of the vehicle consists of two groups 2 and 3 of wheels positioned in axial alignment. In accordance with the embodiment illustrated in the drawings, see Fig. 2, each group of wheels 2 and 3, respectively, comprises three wheels 4, 5, 6 and 7, 8, 9, each. The extreme wheel 4 and 9, respectively, of each group 2, 3 is a driving wheel. Each driving wheel 4 and 9 is driven individually and at a variable speed, if desired. The rest of the wheels 5, 6 and 7, 8, respectively, are mounted freely running on their respective shaft. An electrical setting mechanism 10 displaces a preferably splined roll or elongate roller into simultaneous abutment against the wheels 4, 5, 6 and 7, 8, 9, respectively, in each group. In this manner driving force is transferred

from the respective driving wheel 4 and 9 to the corresponding runner wheels 5, 6 and 7, 8, respectively, so that in consequence thereof all wheels become driving wheels. This could be advantageous in order to prevent grooving of the sensitive surface to be treated, since the propelling force will be distributed over a larger area.

Fig. 3 illustrates a tool arm 13 and a tool 14, merely indicated in dash and dot lines, positioned above a support 15. The tool is attached to a vertical rotary sleeve 6 which is coupled to a driving motor 17. Through the rotary sleeve 16 extends a leg member 18 which in accordance with the embodiment illustrated carries a support plate 19 at its lower end. By means of a screw-threaded shaft 20, preferably a ball screw, and a nut 21 the leg member 18 may be moved axially so as to press the support plate 19 against the support or surface 15. The purpose of placing the plate in abutment against the surface is to relieve the load of the working vehicle on the tool 14 at a point of abutment, which is to be at the centre of the tool 14.

The function of the device in accordance with the invention will be described in the following with reference to the schematical views in Figs. 4 and 5. In accordance with the invention the driving wheel assembly 1 is rotatably mounted for pivotal movement about its centre 22 and its orientation with respect to the tools 14, 23 is such that the imaginary interconnecting lines 24, 25, 26 between the centres of rotation 27, 28 of the tools 14, 23 and between the centre of rotation 22 of the driving wheel assembly 1 and the rotational centres 27, 28 of the respective tool 14, 25, form a preferably equilateral triangle.

When a working vehicle provided with a device of this design is to treat a surface 15, the vehicle is driven in the manner schematically illustrated in Fig. 4. Thus, the vehicle is assumed to be propelled in a straight line from the right to the left at the upper part of the drawing

figure. Consequently, the driving wheel assembly 1 exert a pulling action on the tools 14 and 23, which thus trail behind while treating the support surface 15. When the vehicle has reached a point sufficiently far to the left for the rotational centres 27 and 28 of the tools to assume a position on the imaginary line 29, the vehicle is stopped for a moment. The leg member 18 together with the support plate 19 are lowered into abutment against the surface 15, whereupon the driving wheel assembly 1 is turned and again the vehicle is started, but at this stage only the outer driving wheel 4 or wheel group 2 as a whole act as driving members. The vehicle therefore will pivot about its centre 28. When the centre 22 of the driving wheel assembly and the centre of rotation 28 assume a position on the imaginary line 30, the vehicle is again stopped momentarily. The leg member 18 is now raised again, whereupon the vehicle is driven in a rectilinear motion until said centres 22 and 28 are positioned on an imaginary straight line 31. The vehicle is stopped again, the leg member 18 is lowered to bring the support plate 19 into abutment against the surface 15, the outer driving wheel 4 or wheel group 2 is started, making the vehicle turn until the rotational centres 27, 28 of the tools 14, 23 are again positioned on the imaginary straight line 29. Wwhen this happens the vehicle is stopped again. After the leg member 18 and the support plate 19 having been raised from the surface 15 the driving wheel assembly 1 may be restarted and the vehicle be propelled in a straight line along the lower path as seen in Fig. 4, in a direction opposite to the previous one.

Thanks to the vehicle movement just described no spot or area of the surface will left untreated. Instead, small marginal portions of the upper and the lower path are guaranteed to overlap. Driving in a straight line makes it possible, by varying the driving of the driving wheels 9 and 4, to correct smaller course deviations.

Fig. 6 illustrate one example of an embodiment of an electrically driven working vehicle, equipped with tools 14, 23 for treatment of a surface 15.

The invention is not limited to the embodiment described and illustrated in the drawing figures but may be varied in various ways within the scope of the appended claims. This is true for instance as regards the driving wheels and runner wheels the number of which could be larger or smaller than that shown.

The support plate 19 may be replaced by a support wheel which is moved into abutment against the support 15 like in the manner described. This facilitates transportation of the working vehicle to and from the site of work. In addition, the vertical position of the support wheel may be varied during the propulsion of the vehicle in depending of the force of abutment of the tools against the support 15, for instance to set suitable grinding pressures.

The working vehicle can be used for many various purposes, such as treatment of concrete surfaces, as a cleaning device, to treat skating or ice-hockey rinks and the like. The device is particularly useful on support surfaces having reduced carrying capacity, in which case small pressures against the ground and reduced friction are required.

CLAIMS

1. A device to drive and control a working vehicle arranged to move forwards and backwards across a surface (15) for treatment thereof, said vehicle provided for this purpose with a driving wheel assembly (1) and with two tools (14, 23) arranged, by their rotary motion, to perform said treatment of said surface, c h a r a c - t e r i z e d in that the driving wheel assembly (1) is rotatable about its centre (22) and is orientated with respect to the tools (14, 23) in such a manner that the imaginary interconnecting lines (24, 25, 26) between the centres of rotation (27, 28) of the tools (14, 23) and between the centre of rotation (22) of the driving wheel assembly (1) and the centres of rotation (27, 28) of the respective tools (14, 23) form a triangle, preferably an equilateral triangle, and in that means (18, 19) are provided to relieve the load of the working vehicle on the tool against the surface (15) at the centre of any one of the tools (14, 23) for allowing said vehicle to pivot about said centre (27, 28) upon turning movement of said driving assembly for the purpose of changing the direction of movement of said working vehicle.

2. A device as claimed in claim 1, c h a r a c - t e r i z e d in that each tool (14, 23) is attached to a vertical rotary sleeve (16) which is coupled to a driving motor (17) and through which extends an axially movable leg member (18) arranged to be positioned in abutment against a surface (15) in order to relieve the load from said working tools at the point of abutment.

3. A device as claimed in claim 2, c h a r a c - t e r i z e d in that the leg member (18) carries a support plate (19) at its lower end.

4. A device as claimed in claim 2, c h a r a c - t e r i z e d in that the leg member (18) carries a support wheel at its lower end.

5. A device as claimed in claim 1, c h a r a c - t e r i z e d in that the driving wheel assembly (1) comprises two axially aligned groups (2, 3) of wheel, and in that the outermost wheel (4 and 9, respectively) of each group (2, 3) is a driving wheel whereas remaining wheels (5, 6 and 7, 8, respectively) of each group (2, 3) are runner wheels.

6. A device as claimed in claim 5, c h a r a c - t e r i z e d in that the driving wheels (4, 9) may be actuated individually and at a variable speed.

7. A device as claimed in claim 5, c h a r a c - t e r i z e d in that a roll or other elongate roller element (11 and 12 respectively) is positioned radially externally of each group (2 and 3, respectively) of wheels and is arranged to be moved into abutment against all wheels (4, 5, 6 and 7, 8, 9, respectively) of each group (2 and 3 respectively) in order to transfer the driving force of the driving wheel (4, 9) in the corresponding group onto the runner wheels (5, 6 and 7, 8 respectively) of that group (2 and 3 respectively).

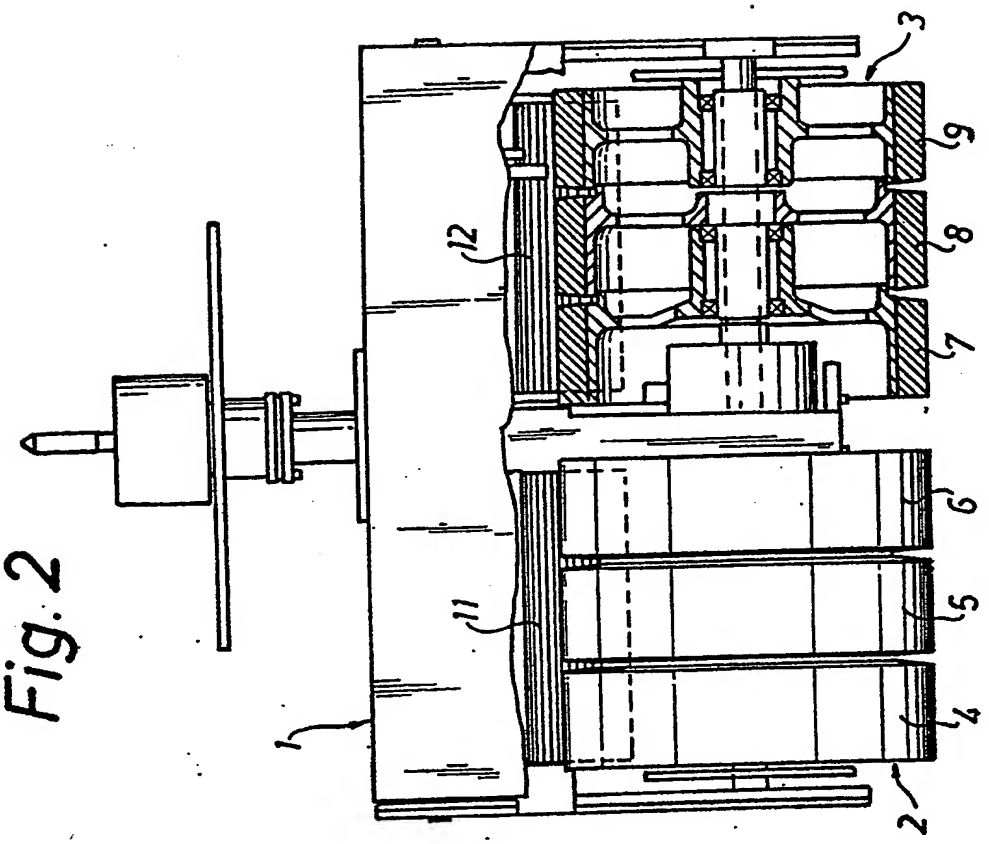

Fig. 2

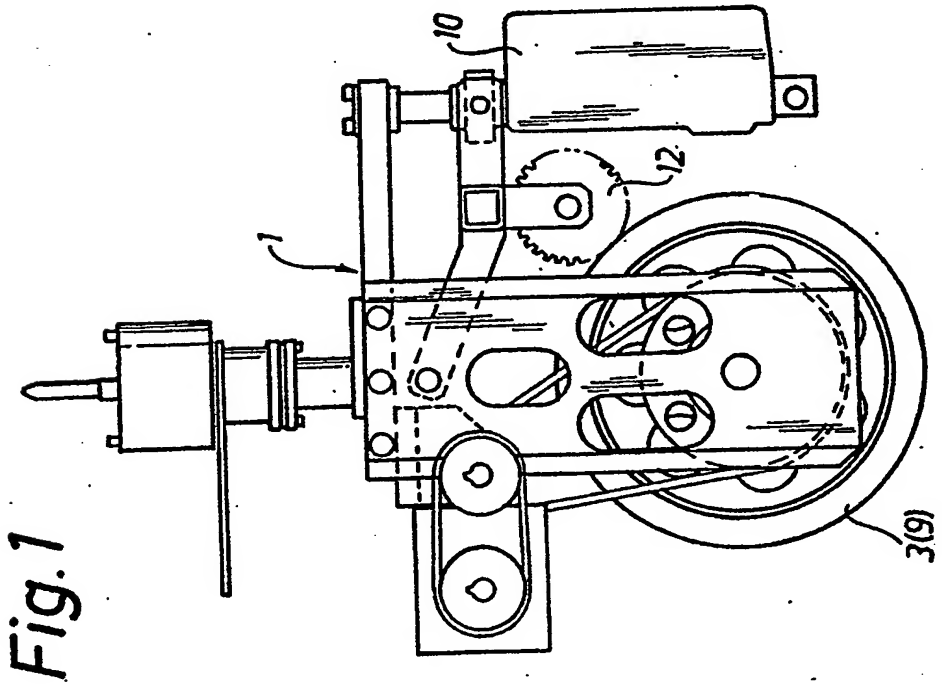

Fig. 1

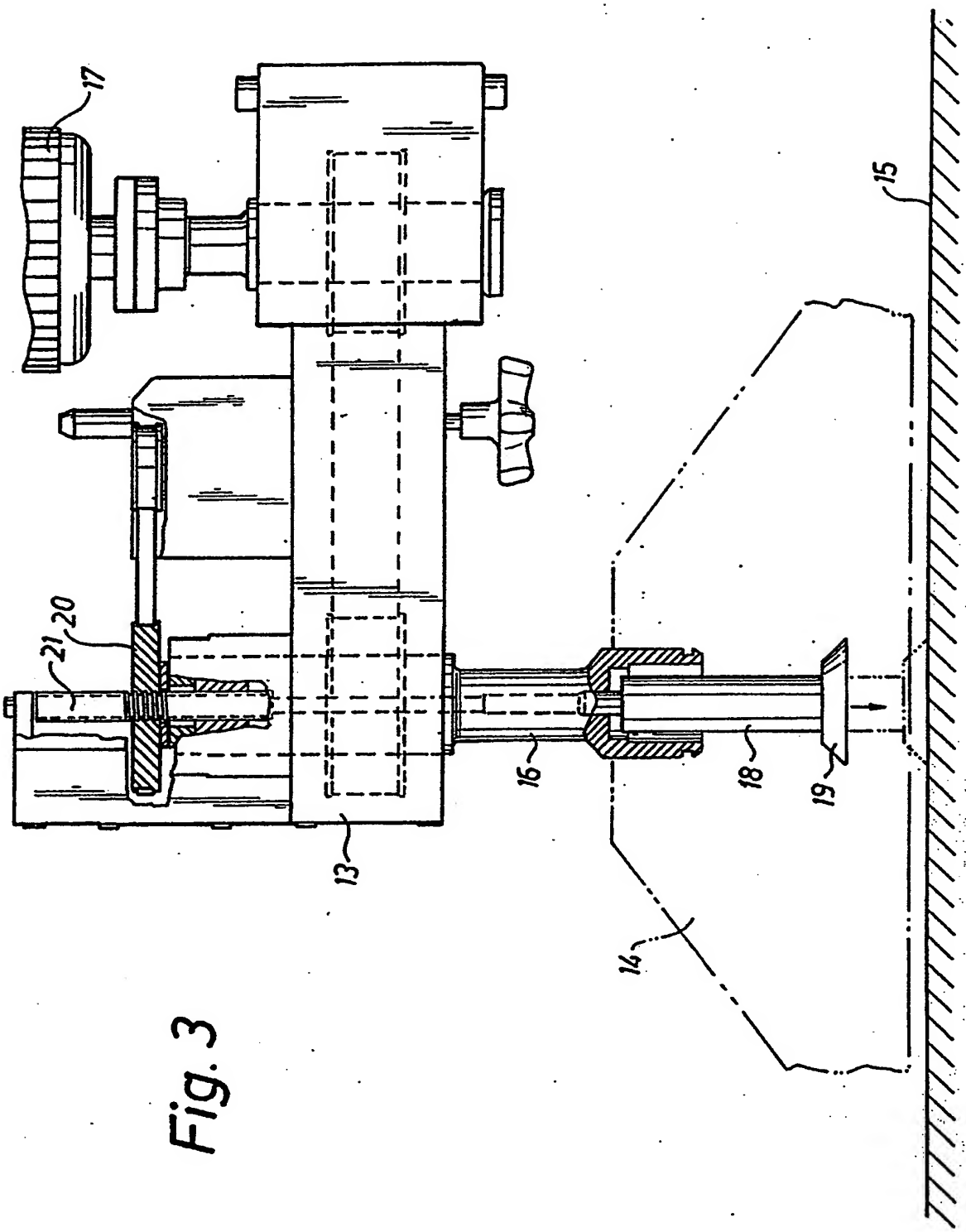

Fig. 3

Fig. 4

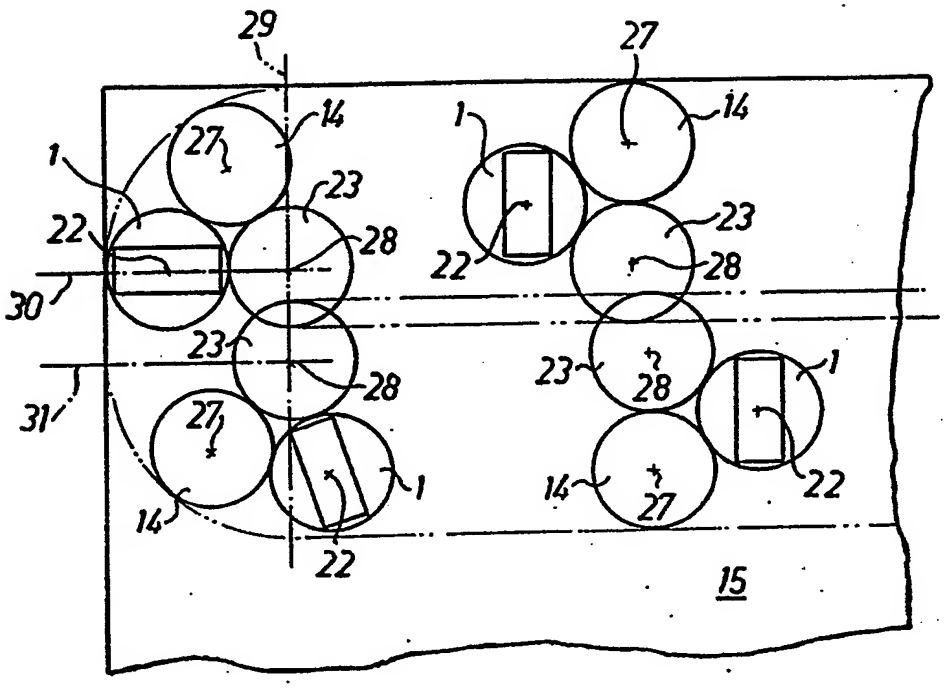
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Fig. 5

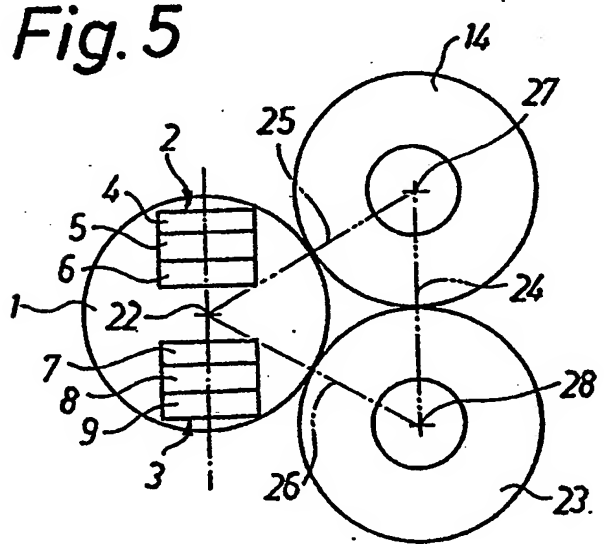
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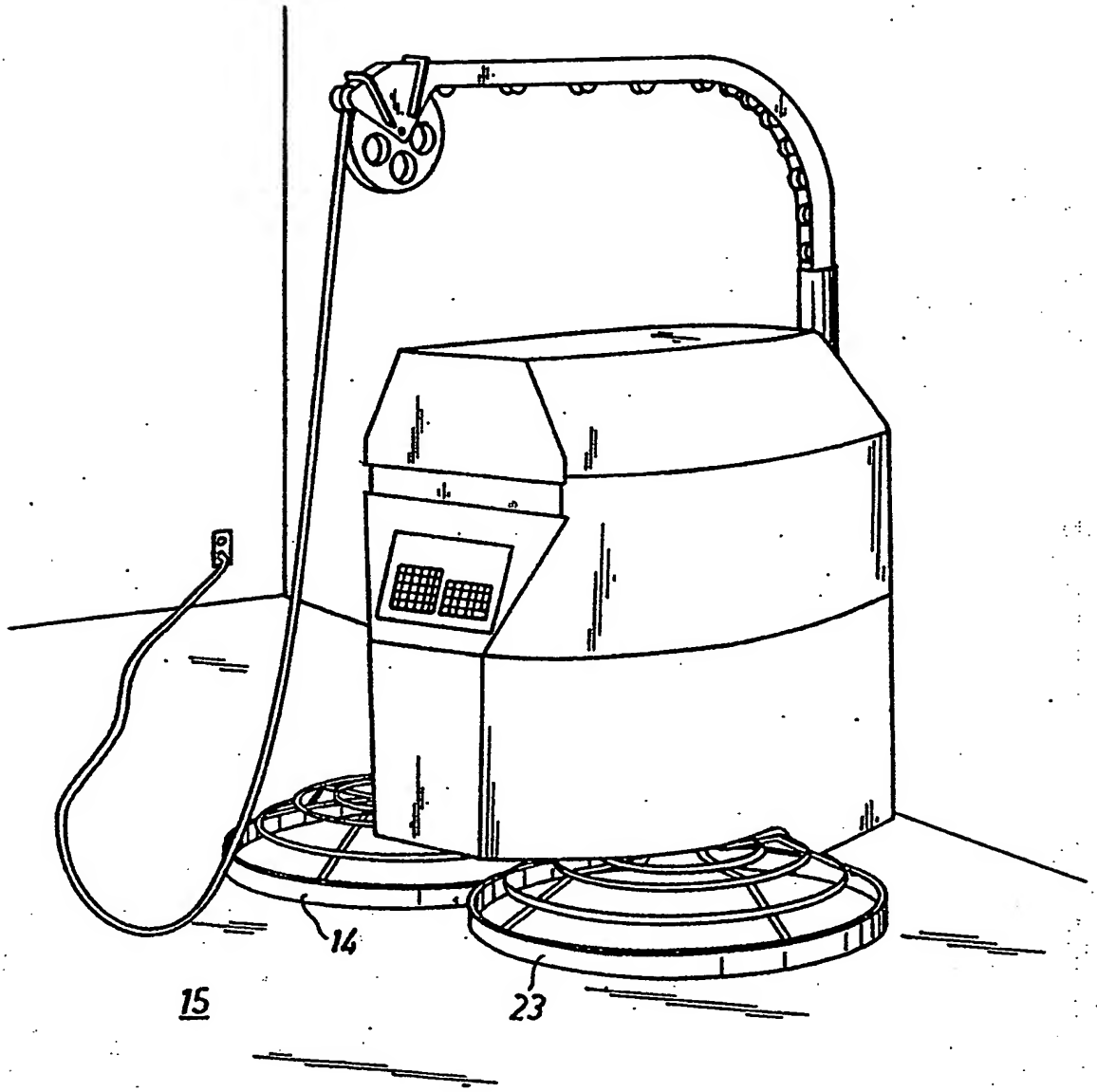
Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 94/01072

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E04F 21/24, B24B 7/18, B62D 15/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: E04F, B24B, B62D, E04G, A47L, E01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 3936212 (O.H. HOLZ, SR. ET AL), 3 February 1976 (03.02.76), the whole document --	1
A	WO, A1, 9202334 (CONCRETE GRINDING LTD.), 20 February 1992 (20.02.92), the whole document --	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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